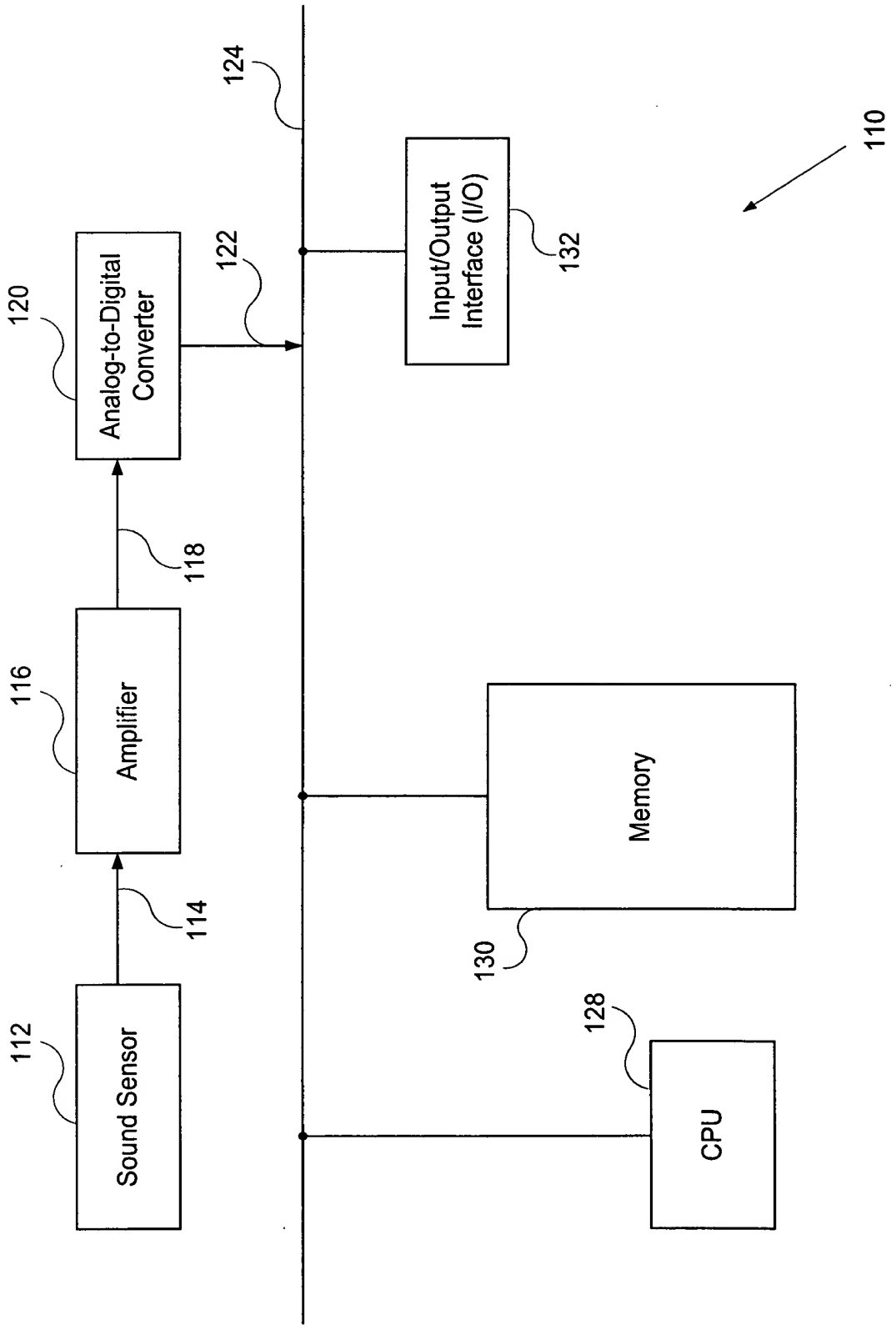
110
124
Input/Output Interface (I/O)
132
122
120
Analog-to-Digital Converter
118
116
Amplifier
114
112
Sound Sensor
Memory
130
128
CPU

Fig. 1

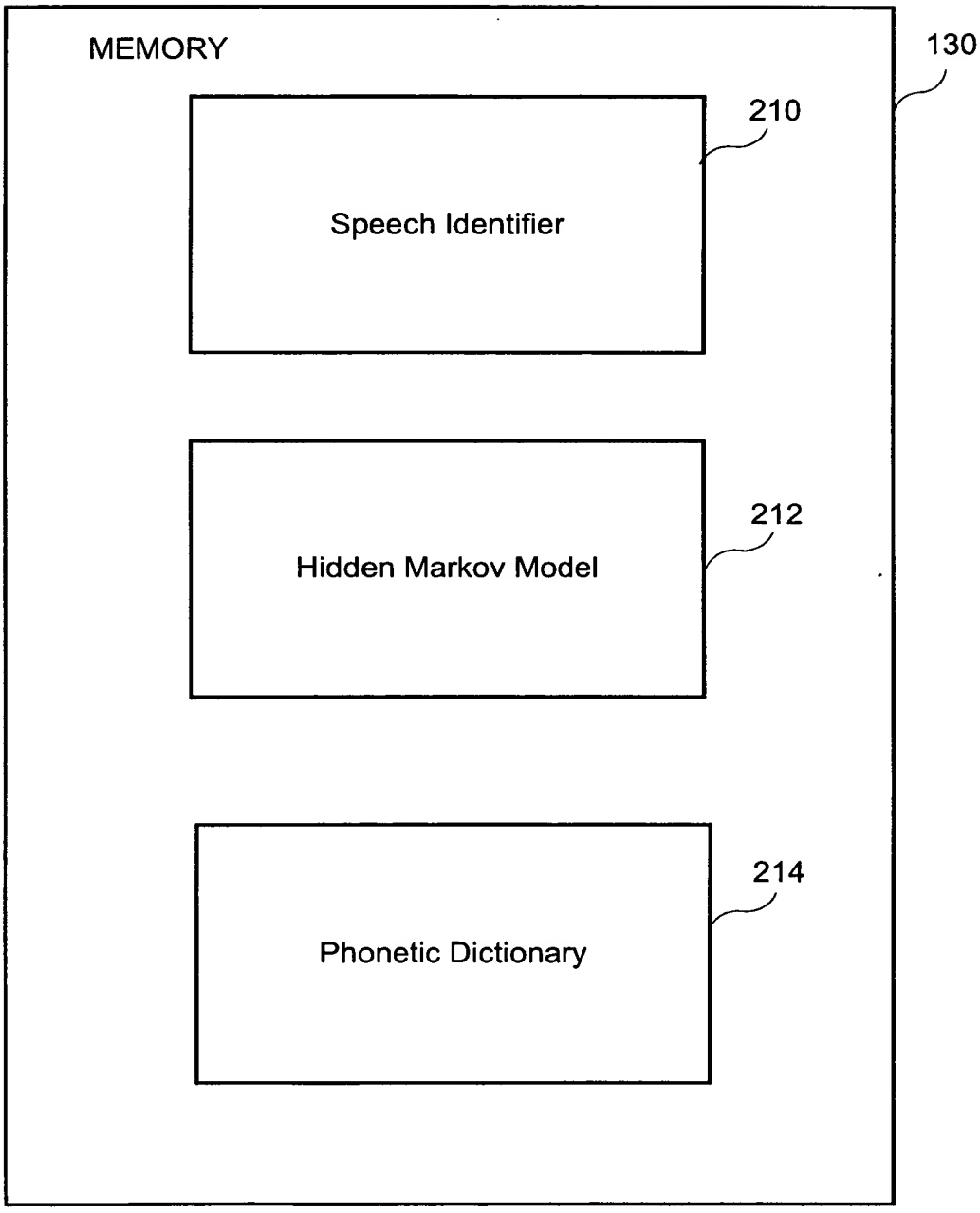
MEMORY
130
210
Speech Identifier
212
Hidden Markov Model
214
Phonetic Dictionary

FIG. 2

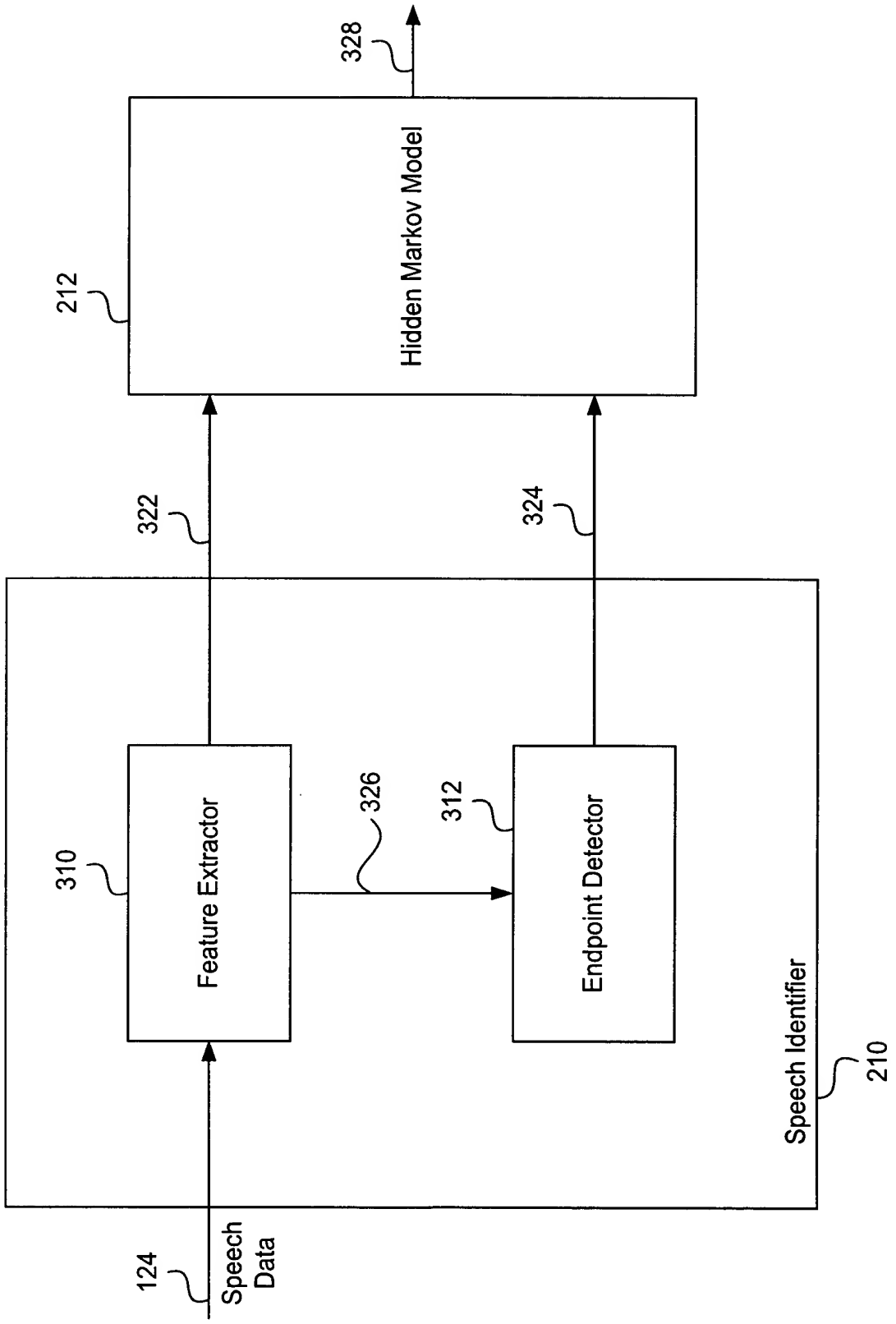
328
Hidden Markov Model
212
322
324
310
Feature Extractor
326
312
Endpoint Detector
Speech Identifier
210
124
Speech Data

Fig. 3

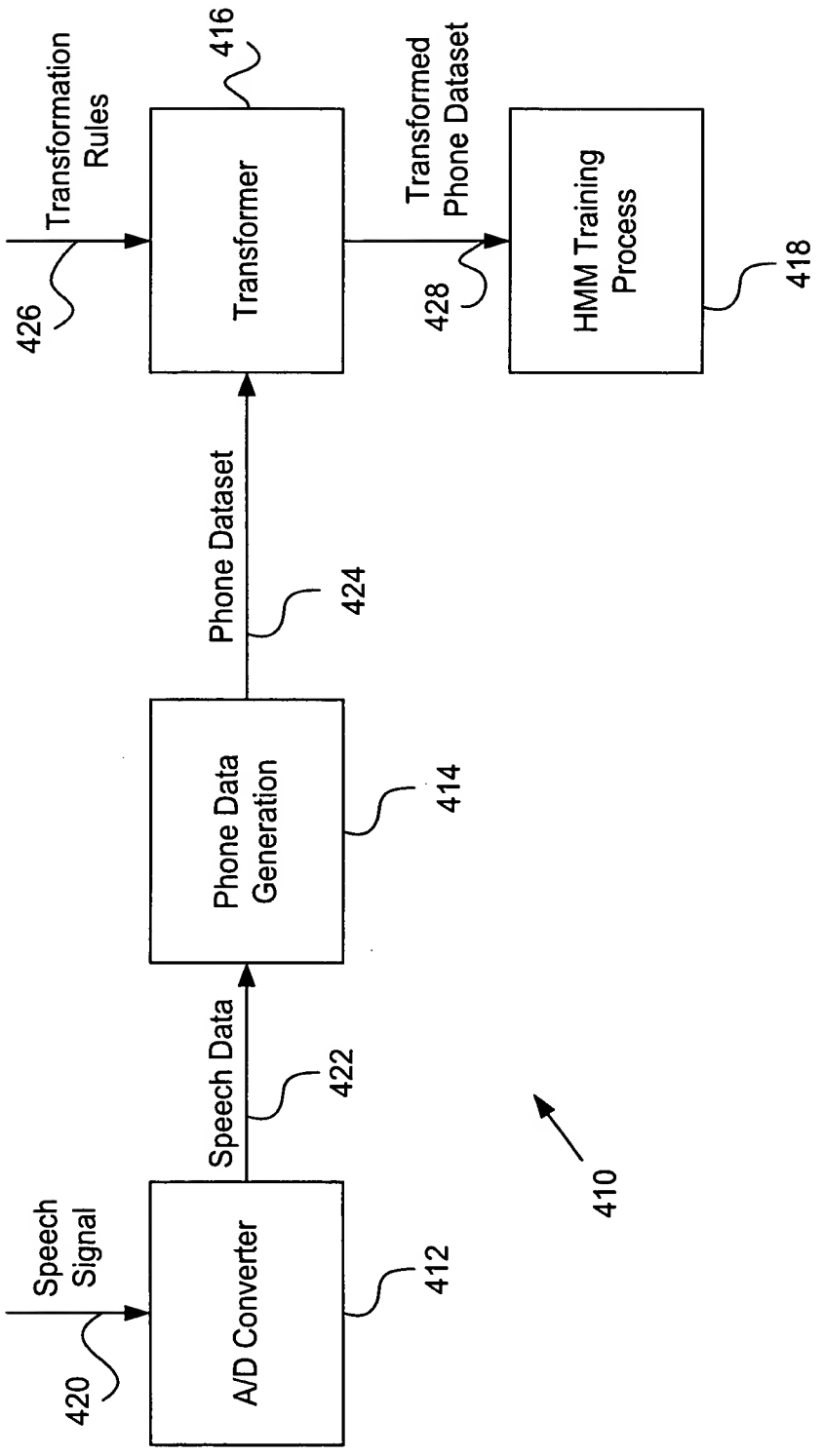
Speech Signal
420
A/D Converter
412
Speech Data
422
Phone Data Generation
414
Phone Dataset
424
Transformation Rules
426
Transformer
416
Transformed Phone Dataset
428
HMM Training Process
418
410

Fig. 4

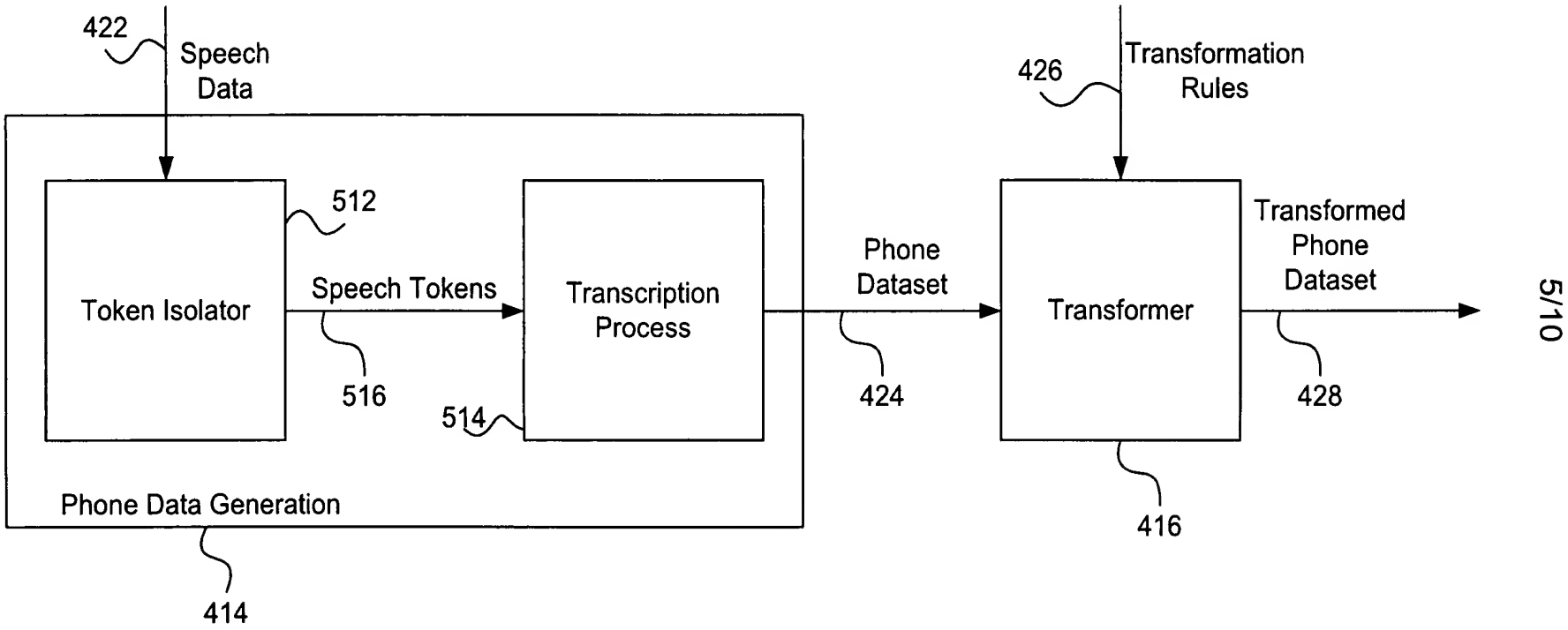
422
Speech Data
426
Transformation Rules
512
Token Isolator
Speech Tokens
516
514
Transcription Process
Phone Dataset
424
Transformer
Transformed Phone Dataset
428
416
Phone Data Generation
414

Fig. 5

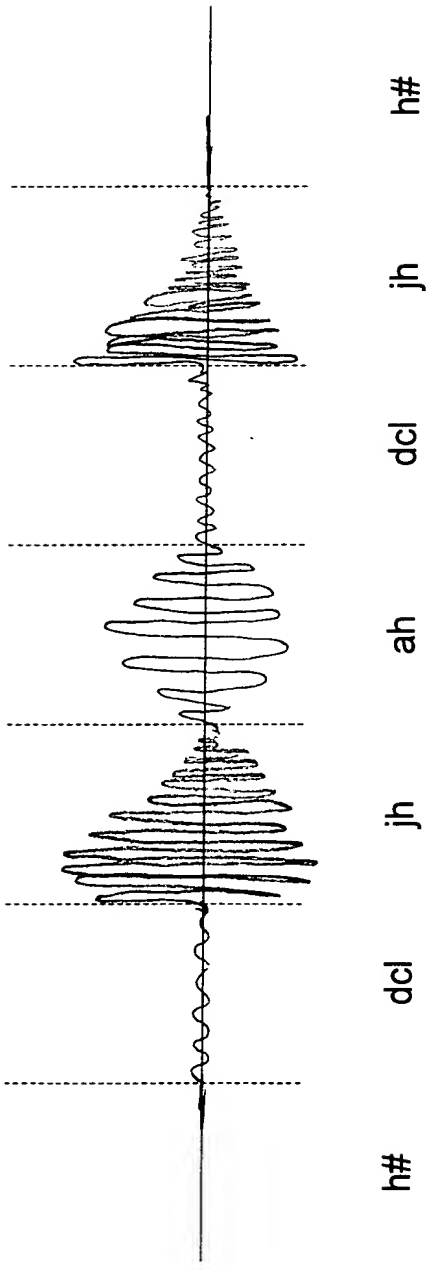

Fig. 6

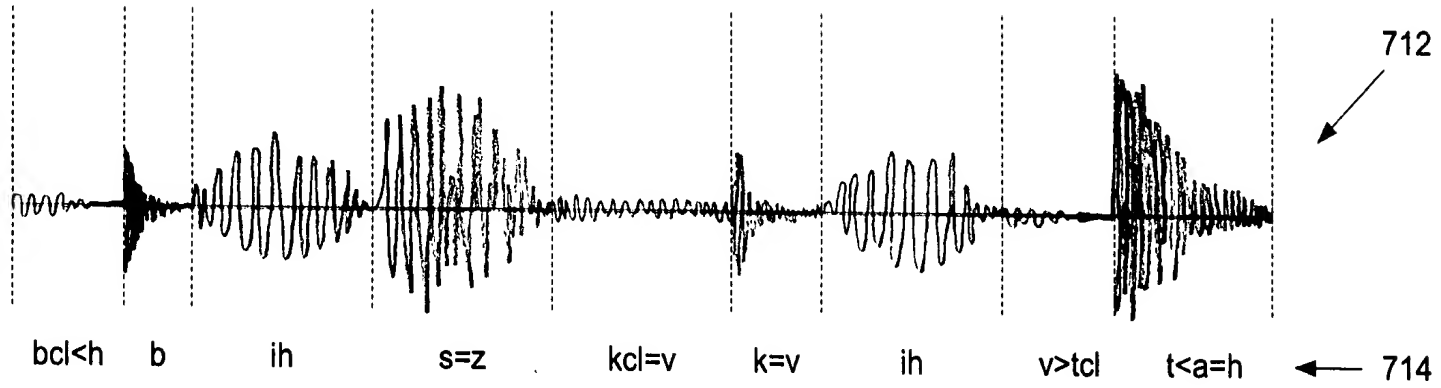

Fig. 7(a)

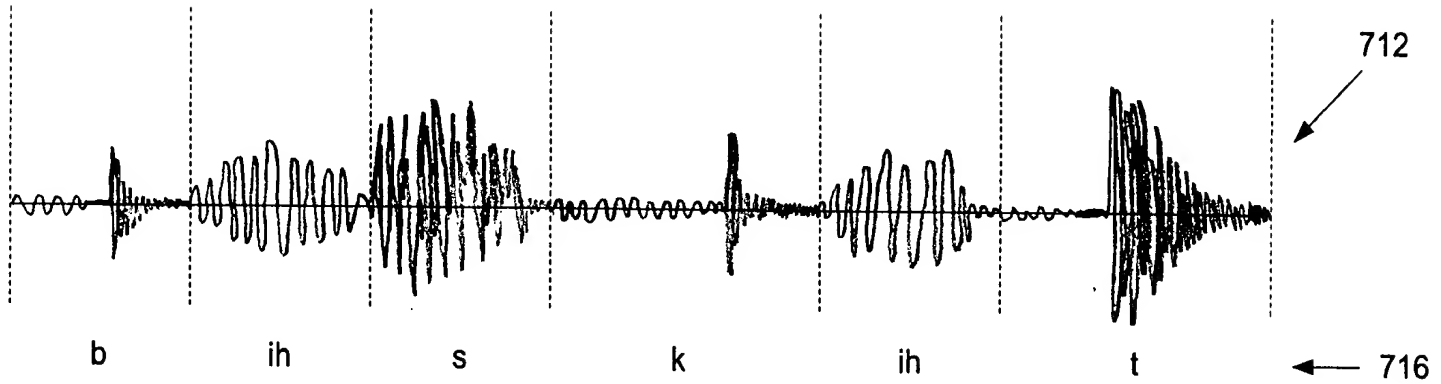

Fig. 7(b)

Category	Base Phones
Stops and Affricates	b d g p t k dx q jh ch
Fricatives	s sh z zh f th v dh hh hv
Nasals	m n ng em en eng nx
Semivowels and Glides	l r w y
Diphthongs and Syllabics	ey aw ay oy ow er axr el
Vowels	iy ih eh ae aa ah ao uh uw ux ax ix ax-h
Silence, Closure, Pause	h# epi pau bcl dcl gcl pcl tcl kcl
Stress	1 2
Variation of glottal stop	qq qh qcl qclq qqcl hqq hqh
Multiple burst releases	pp tt kk bb dd gg jhjh chch
Closures of fricative consonants	fcl thcl scl shcl vcl dhcl zcl zhcl
Vowel velarization/lateralization	al ol ul
R-coloring	or ar ixr
Glide loss	ee oo
R-deletion	ax_ e_ ix_ ri ra
Labio-velar fricative	hw
Articulator noise	l# b# hh# w# g# ly# ll# lq#

812

814

810

Fig. 8(a)

Acoustic-phonetic Process	Symbol
Nasalization	n
Glottalization variance	q qh hq qs
Breathiness	b
Labialization	w
Palatalization or whistle	y
Voicing	v
Devoicing	h
Voiced Frication	z
Voiceless Frication: low freq.	hh
Voiceless Frication: high freq.	s
Epenthetic Vowel	a
Murmur	m
Air Puff	p
Burst Quality	t
Approximation	c
No Burst/Release	u
Tongue click	x

816

Fig. 8(b)

MERGE	bcl b :	b
MERGE	tcl t :	t
MERGE	kcl k :	k
SPLIT	em :	ah m
SPLIT	or :	ao r
SPLIT	al :	aa l
REPLACE	gg :	g
REPLACE	qclq :	q
SPLIT	aa=n :	aa n
REPLACE	p=v :	b
CHANGE IN CONTEXT	aa=n :	aa < n m ng

912

Fig. 9

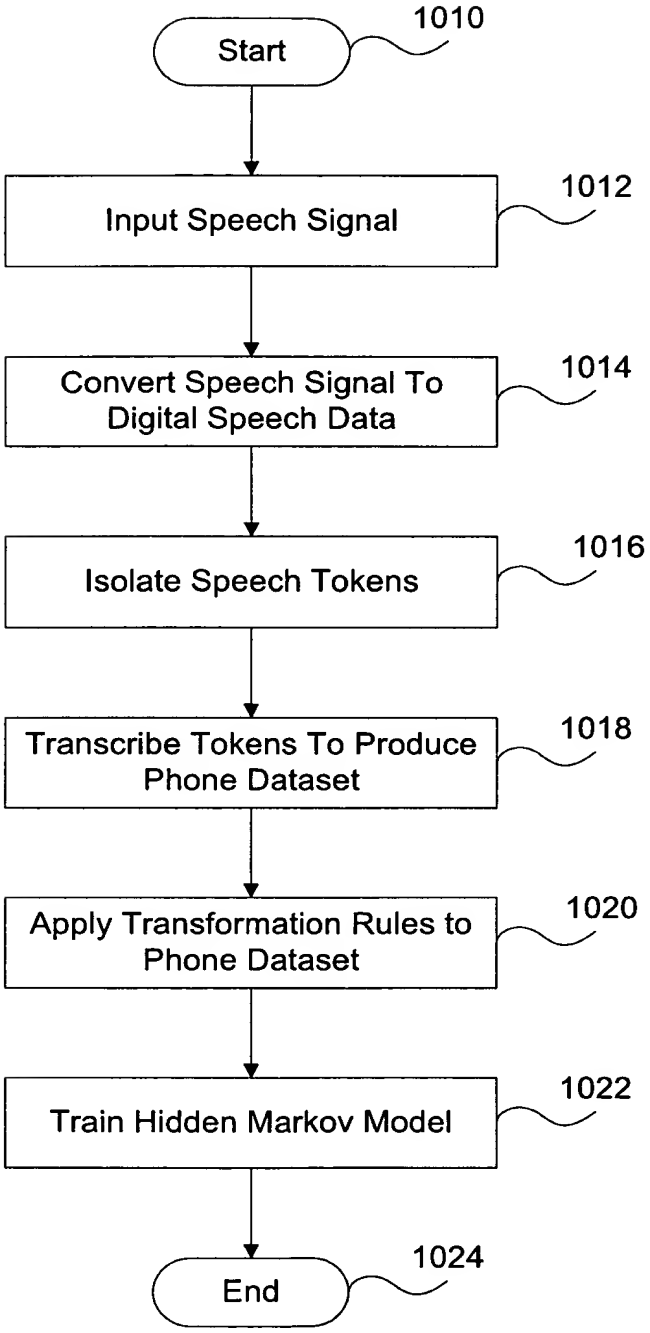
1010
Start
1012
Input Speech Signal
1014
Convert Speech Signal To Digital Speech Data
1016
Isolate Speech Tokens
1018
Transcribe Tokens To Produce Phone Dataset
1020
Apply Transformation Rules to Phone Dataset
1022
Train Hidden Markov Model
1024
End

Fig. 10